

Exotic Phenomena Observed by the Meteor Radar at High Latitudes

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In the Sodankylä Geophysical Observatory (SGO, 67° 22' N, 26° 38' E, Finland) the SKiYMET meteor radar is operating since December 2008. During this time a number of exotic phenomena were observed.

First, the mesospheric temperature derived from meteor decay times appears systematically underestimated by 20 – 50 K during the Geminids meteor shower which has peak on 13 December. These observations are for a specific height-lifetime distribution of the Geminids meteor trails, which indicate a larger percentage of overdense trails compared to that for sporadic meteors and, hence unusual properties (mass or chemical composition) of the Geminids meteoroids. Similar properties were found also for Quadrantids, but not for other meteor showers.

Second, unusual echoes from regions of active aurora are sometimes detected at low elevation during substorms. These echoes have a near-zero Doppler shift and oscillating amplitude (at a frequency higher than 1.7 Hz). We suggest that such echoes are in fact ground backscatter of the radar waves passing through the ionosphere in the region, where pulsating aurora occurs.

Third, on 9 December 2009 a solid propellant ballistic rocket was self-destroyed in the ionosphere in a 500-km vicinity of SGO. After that the meteor radar received unusual echoes, which indicate turbulence of ionospheric plasma (irregularities of electron density) obviously associated with aerosol particles of the missile remains. Mechanism for such irregularities might be similar to that of polar mesosphere summer echo.